



Ref. No.: SYN15/PS202112/01

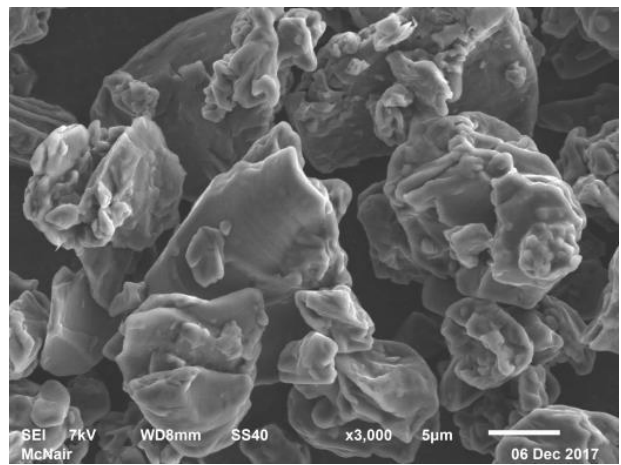
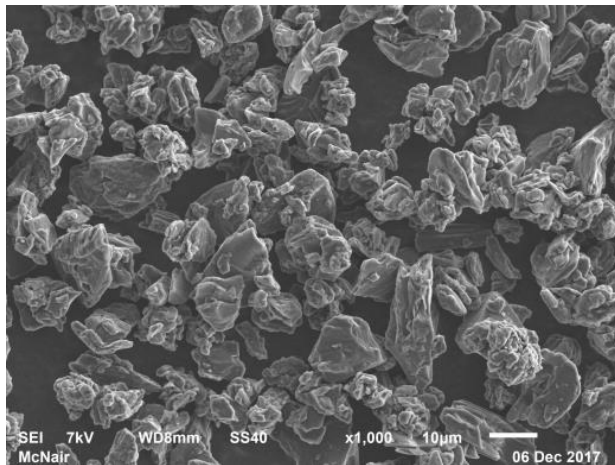
Last Update: 6 December 2021

SYN-15 Product Specification

Applications: polymer batteries and cylindrical batteries.

1. Technical characteristics:
SYN-15 is a synthetic graphite product of secondary granulation which has the characteristics of small volume expansion, long cycling life, low self-discharge rate, good permeability, and low graphite sheet electrode deformation rate.
2. Suggested usage: (For reference only)
Suitable for aqueous lithium-ion batteries with design specific capacity at 340Ah/g, pellet density at 1.45-1.60g/cm³.

Scanning Electron Microscope





3. Technical Data

Item	Unit		Typical Value	Specification	Testing Method/ Instrument
Particle Size	D10	μm	6.99	≥6.0	Laser diffraction Malvern Mastersizer 3000
	D50	μm	14.77	15.0±2.0	
	D90	μm	27.44	≤36	
	Dmax	μm	52	<70	
Tap Density	g/ml		1.03	1.10±0.1	Central Iron & Steel Research Institute Model: FZS4-4B
Special Surface Area	m ² /g		1.70	1.5±0.5	Multi point BET (adsorption N ₂) Quantachrome Nova 4000E
Moisture	%		0.02	≤0.10	Gravimetric method Mettler Toledo ME204T/02 Standard Analytical Balance
Ash	%		0.01	<0.10	Gravimetric method, Muffle furnace 950°C
Pellet Density	g/cm ³		1.52	1.45-1.60	Guangzhou Lange Electronics Model: CLG-ZM-400Y
Specific Capacity	mAh/g		345	≥340	Half-Cell Testing, using lithium metal as counter electrode
Initial Coulombic Efficiency	%		92.33	≥92	Arbin multifunctional battery testing equipment Model: BT2000
Cu	ppm		4.43	≤10	Inductively Coupled Plasma Thermo Scientific ICP 7000 Plus Series
Fe	ppm		7.70	≤30	
MO	ppm		0.000	≤10	
Magnetic	ppm		0.035	≤3	



4. Formulation and procedures of anode material production: (for reference only)

Proportion	SYN-15 : CMC : SBR : SP = 95.5 : 1.5 : 2.0 : 1
Thickener	SUNROSE MAC350HC
Bonding Agent	CB-100 (JSR)
Solid content	45%
Viscosity	3000 mpa.s
Mixing equipment	Blender (Hongyun)

Feeding order and procedures:

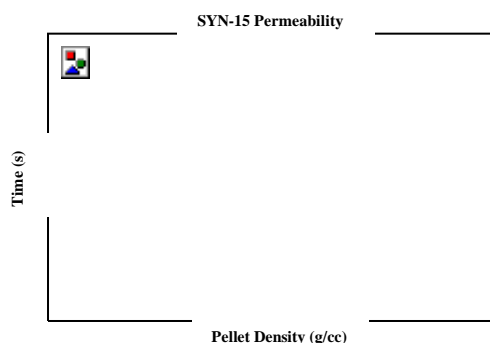
1. After being weighted, CMC be put into 90% first batch of water and mix for 2.0 hours (rotation/revolution speed: 30/25Hz).
2. Add Super-p and mix for 2.0 hours (rotation/revolution speed: 30/25Hz).
3. Add graphite and mix for 2.0 hours (rotation/revolution speed: 20/25Hz).
4. Add SBR and mix for 1.5 hours (rotation/revolution speed: 25/20Hz).
5. Measure the viscosity.
6. Depends on the viscosity, add 10% second batch of water and mix 1.0 hour (rotation/revolution speed: 30/25Hz). Adding second batch of water is for adjusting viscosity purpose.
7. Mix at a low speed for 30 minutes (rotation/revolution speed: 5/10Hz).

5. Absorbent permeability test in different pellet density

Measurement setup:

Absorbent:

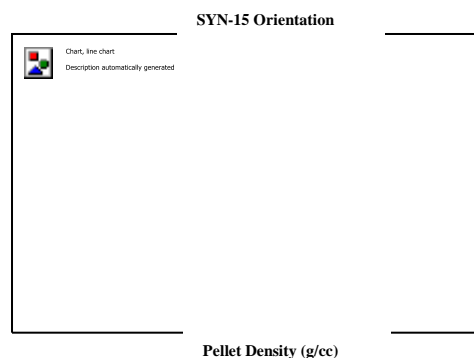
LiPF6 1mol/L,
EC : DEC : DMC = 1 : 1 : 1,
Volume: 1μL



6. Test of orientation in graphite sheet electrode

Measurement setup:

1. Equipment: X-ray diffraction (XRD)
2. Graphite sheet electrode
3. Formulation:
SYN-15 : CMC : SBR : SP = 95.5 : 1.5 : 2.0 : 1
Coating: single side
Cufoil: 12 μm
4. Scan speed: 0.082
5. Scan step size: 0.0066
6. Scan angle: I004 (52~56 degree); I110 (75~79 degree)

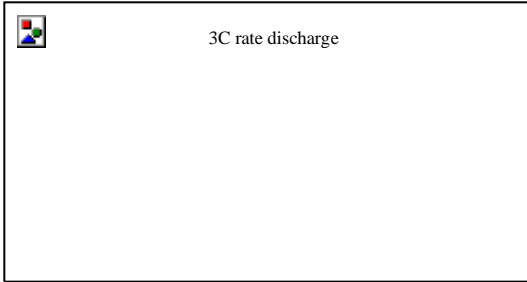




7. Test of battery capacity

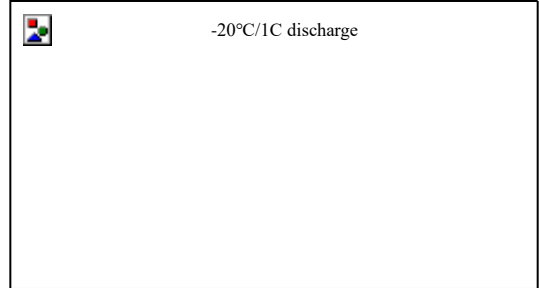
Room Temperature 3C Rate Test

Room Temperature 3C Discharge				
	Initial	3C discharge	Retention	Standard $\geq 90\%$
1#	123.105	125.867	102.24%	OK
2#	124.744	126.107	101.09%	OK
11#	123.916	123.907	99.99%	OK
12#	124.466	124.477	100.01%	OK

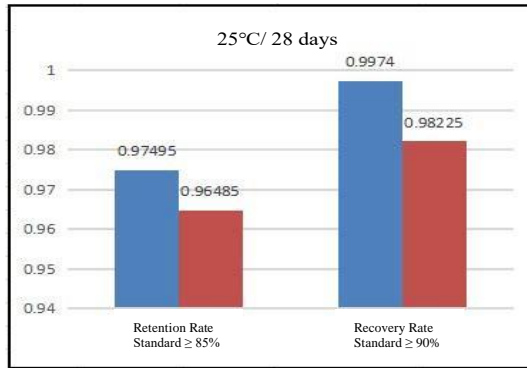


Low Temperature Test

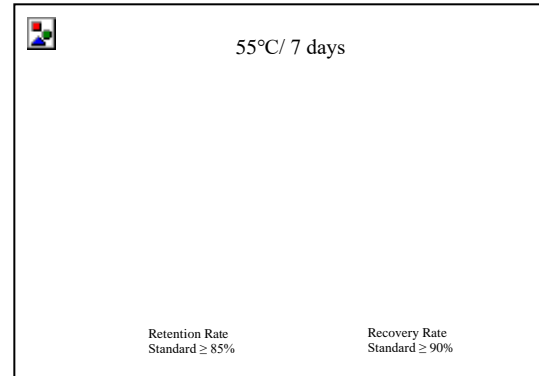
-20°C Discharge			
	Initial	Discharge	Retention
1# (2.3V)	123.105	80.664	65.52%
2# (2.3V)	124.744	82.331	66.00%
11# (2.3V)	123.916	79.331	64.02%
12# (2.3V)	124.466	77.998	62.67%



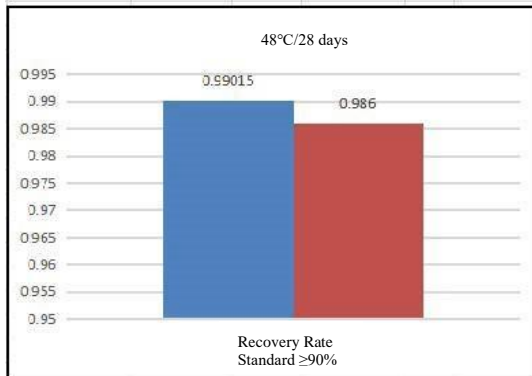
Room Temperature fully charged storage



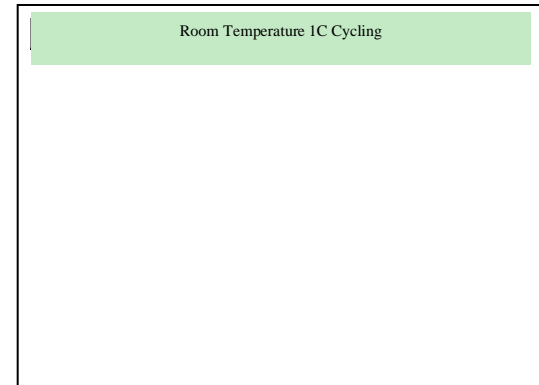
High Temperature fully charged storage



Half charged storage



Cycling performance





8. Environmental compliance of product

The product complies with EU RoHS Directive (Restriction of Hazardous Substances in Electrical and Electronic Equipment), the concentration of toxic and hazardous substances or elements contained in the product does not exceed the limit specified in SJ/T 11363-2006 “Limit Requirements for Toxic and Hazardous Substances in Electronic Information Products”.

9. Packaging and labeling

The product is packaged by a vacuum packaging machine, first put into an inner film bag, formed, heat-sealed, and then put into a carton with a net weight of 25.0 ±0.1kg/carton, or packed according to customer requirements.

The packaging label includes: product name, batch number, packaging specification, production date, factory date, order number, inspection mark, RoHS mark, as well as company name, LOGO, and other customized information.

10. Storage and transportation

The product should be stored in a ventilated and dry warehouse and avoid mixing with materials that can deteriorate the product or damage the packaging bag during storage and transportation.

Unopened product has 1 year of durability period. Opened product should be used within one month and kept clean and dry.